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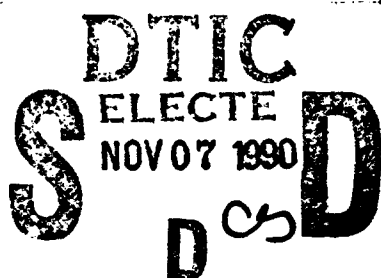
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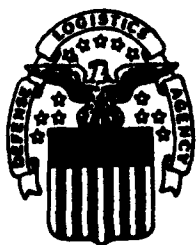
DEPARTMENT OF DEFENSE

DEFENSE LOGISTICS AGENCY

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Impact of Competition on Quality

Russell S. Elliott

DEPARTMENT OF DEFENSE
DEFENSE LOGISTICS AGENCY
OPERATIONS RESEARCH AND ECONOMIC ANALYSIS OFFICE
CAMERON STATION
ALEXANDRIA, VA 22304-6100

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DEFENSE LOGISTICS AGENCY
HEADQUARTERS
CAMERON STATION
ALEXANDRIA, VIRGINIA 22304-6100

FOREWORD

The Defense Logistics Agency (DLA) Competition Advocate Office
requested that DLA's Operations Research and Economic Analysis Office
(DLA-LO) determine the impact of competition and how it affects the
quality of items bought by the Defense Supply Centers (DSCs). This
report details the analysis of how competition impacts quality of
DLA-managed items. Specifically addressed were how the quality
patterns of items broken out from sole source to multiple sources and
those items which reverted from multiple sources to sole source have
changed.

The analysis indicated that for the vast majority of items broken out
to competition that there were no recorded valid contractor-caused
complaints from the Customer Depot Complaint System (CDCS) file and no
recorded Quality Evaluation Program (QEP) actions. When complaints
from CDCS were present, the results were mixed. When QEP activity
occurred, it was more frequent after breakout than before. This
increased QEP level was typically due to increased oversight
(pre-award surveys, first article tests, and Quality Assurance Letters
of Instruction) and not necessarily because of quality problems.
Therefore, it appears that there were no measurable differences in the
quality of items broken out to competition. However, to prevent a
possible decline in quality, a DSC will occasionally increase its
level of quality oversight functions.

There are no recommendations from an agency management perspective.
However, from an analytical perspective, this issue should perhaps be
analyzed again in the future when more extensive data has been
accumulated and/or the procurement environment has changed.

Christine L. Gallo.

CHRISTINE GALLO
Deputy Assistant Director
Policy and Plans

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EXECUTIVE SUMMARY

In Fiscal Year 1986, the Defense Logistics Agency (DLA) Competition Advocate requested that an analysis be conducted on the impact of competition on the quality of items bought by the Defense Supply Centers (DSCs). This was requested since it was unclear what impact the many recent competition and contracting initiatives had on the quality of DLA-managed items. The Operations Research and Economic Analysis Office (DLA-LO) agreed to undertake the project, but this effort was initially backlogged due to lack of data. With recent DLA-LO experience with the Customer Depot Complaint System (CDCS) and Quality Evaluation Program (QEP) data bases, DLA-LO believed that sufficient data existed to activate this project during 1989.

The thrust of this analysis was to measure competition and quality indicators both prior to and after changes in the competition status codes. This was accomplished by having competition measured by changes in the Acquisition Method Code/Acquisition Method Suffix Code that indicated an item was broken out from sole source to competition or that an item reverted from competition to sole source. Only items with subsequent awards after the change in competition status and purchased from manufacturers were considered. Quality indicators were derived from two sources. The CDCS file tracked quality problems or complaints (Product Quality Deficiency Reports and Reports of Discrepancy) and the QEP file tracked actions designed to assure quality (First Article Data, Preaward Surveys Data, Post Award Data, Nonconformance Data, Special Quality Assurance Data, Quality Assurance Letter of Instruction and Quality Data). Finally, the analysis sought to determine the actual impact of competition on quality by comparing the quality patterns both prior to and after the competition status changes.

The results of the study showed that for the vast majority of contract lines (i.e., average of 96 percent) there were no valid contractor-caused complaints on file before or after a change in competition status. When complaints were present the results were mixed. For example, at two centers the number of complaints increased after breakout to competition and the other two centers experienced the opposite effect. The vast majority of the time (i.e., average of 96 percent) there were no QEP actions required before or after a change in competition status. When QEP activity occurred, it was more frequent after breakout than before. Therefore, it appears that there was no measurable differences in the quality of items after break out to competition. However, to prevent a possible decline in quality, a DSC will occasionally increase its level of quality oversight functions.

The analysis of the data used showed that the data had some limitations. The data used for this study was from relatively new data bases. The restricted time period analyzed and the infrequency of occurrences of complaints and QEP actions may have influenced the results.

There are no recommendations from an agency management perspective. From an analytical perspective, this issue should perhaps be analyzed again in the future when more extensive data has been accumulated and/or the procurement environment has changed.

I. INTRODUCTION

A. **Background.** The impact of competition and how it affects the quality of items bought by the Defense Supply Centers (DSCs) was unknown. Therefore, in Fiscal Year (FY) 1986 the Defense Logistics Agency (DLA) Competition Advocate requested that a study be conducted to investigate the impact of competition on quality. The Operations Research and Economic Analysis Office (DLA-LO) agreed to undertake the project, however this effort had been backlogged due to lack of data. With recent DLA-LO experience with the Customer Depot Complaint System (CDCS) and Quality Evaluation Program (QEP) data bases, DLA-LO believed that sufficient data existed to initiate this project during FY 89.

B. **Problem Statement.** It was unclear what impact the many recent competition and contracting initiatives have had on the quality of DLA-managed items. This study addressed the issue of how competition impacted quality of DLA-managed items.

C. **Objectives.** The objectives of this study were to measure competition of DSC items, to measure quality of DSC items, and to compare quality before and after a change in competition status. For this study, breakout was defined as an item which changed from a sole source manufacturer to multiple manufacturers. Reversion was defined as an item which changed from a competition environment to a sole source manufacturer. The first objective was to identify the National Stock Numbers (NSNs) broken out to competition, which was the measure of competition. The second objective was to determine the measures of quality for these items. Finally, the third objective was to determine the actual impact of competition on quality through the investigation of quality patterns before and after a change in competition status.

D. **Scope.** A data base was created from records from the following data files: the Active Contract File (ACF); the CDCS files; the Contracting Technical Data File (CTDF); and the QEP files. Only items broken out from a sole source manufacturer to other manufacturers determined by subsequent contract awards were evaluated. The following centers were analyzed: the Defense Construction Supply Center (DCSC); the Defense Electronics Supply Center (DESC); the Defense General Supply Center (DGSC); and the Defense Industrial Supply Center (DISC). The study excluded the Defense Fuel Supply Center, the Defense Personnel Support Center (DPSC) - Clothing and Textile, DPSC - Medical, and the DPSC - Subsistence due to their special nature. The time frame of the data used varied depending on the particular data base and center. Table 1, shows the time frame for each data base by center.

II. CONCLUSIONS

A. **CDCS Results.** For the vast majority of contract lines (i.e., 96 percent) there were no valid contractor-caused complaints on file before or after breakout or reversion. When complaints were present the results were mixed. For both DCSC and DISC, the apparent impact of competition on quality has been to decrease the number of customer depot complaints, whereas for both DESC and DGSC the opposite effect has been observed.

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Table 1

DATA SOURCES AND TIME FRAMES

Data File	Center(s)	Time Frame
ACF	ALL	1982 through 1989
CDCS	DCSC,DGSC	1982 through 1989
	DESC	1984 through 1989
	DISC	1983 through 1989
CTDF	DCSC	1987 through 1989[*]
	DESC	1985[*] through 1989[*]
	DGSC,DISC	1982 through 1989[*]
QEP	ALL	1985 through 1989

[*] 2nd quarter

B. <u>QEP Results.</u> Most of the time (i.e., 96 percent), there were no QEP actions required before or after breakout or reversion. When QEP activity occurred, it was more frequent after breakout than before. Therefore, the act of breaking out an NSN can require additional efforts to assure quality products as measured by the QEP data.

C. <u>Overall.</u> The overall results potentially indicated that the various centers may have emphasized and/or implemented the competition programs under different strategies. Additionally, there appeared to be other factors and/or events (e.g., technology level of commodities) which influenced the study results more than changes in competition. Consequently, no overall conclusion could be reached with respect to the development of quality trends due to competition effects which would be applicable across all centers.

III. <u>RECOMMENDATIONS</u>

o From an agency management perspective, no recommendations are made.

o From an analytical perspective, this issue should perhaps be analyzed again in the future when more extensive data has been accumulated and/or the procurement environment has changed.

IV. **BENEFITS.** The benefits of this study were non-quantifiable. The study showed that the impact of the various competition initiatives on quality varied from center to center. The centers which had adverse effects could learn from those centers that had beneficial effects, and improvement in quality may be possible with continued emphasis on competition. However, the cost of achieving this improvement may negate some of the savings associated with lower prices attributed to competition.

V. **IMPLEMENTATION.** This study represented a research and fact finding effort. The results of this study were for management information purposes and consequently do not require implementation. The only follow-on effort should be to investigate why the results are not consistent from center to center.

VI. **METHODOLOGY.** The methodology for this study started with a literature review. The purpose of the literature review was to determine the extent of existing literature devoted to competition and quality issues, to determine how other agencies and private businesses define competition and quality, and to determine how to develop a model that would test the impact of competition on quality. The development of measurements of competition were next in order to define and determine what was competition. Then the development of measurements of quality were required in order to quantify quality. Finally, an analysis of the data was conducted to assess the impact that competition had on quality. These aspects of the study are discussed below.

A. Literature Review

An extensive literature review was conducted using the Defense Logistics Studies Information Exchange data base for studies and models relating to the evaluation of competition on quality. A review of literature was also conducted using the resources of a local university library to determine how private industry measures both competition and quality. These reviews indicated that both government and private industry have differences in how they define competition and quality. Studies relating to quality issues were found. Also, other studies relating to competition issues were found. The literature review failed to find any studies that directly related competition and quality.

The current private industry practice was found to be shifting to a single source of supply [1]. A single source was defined as using only one source of supply for a product when more then one source existed whereas a sole source was defined as the only manufacturer of an item or the item was not available from any other source. For example, copier paper could be purchased from numerous manufacturers and vendors. Alternatively, a company could select the ABC company to purchase all their copier paper supply. Consequently, ABC would then be a single source for the copier paper, but not a sole source.

Although, the Federal Government is prohibited by the Federal Acquisition Regulations from operating in this manner [2], there exist numerous reasons within industry for employing a single source. The most common of these would be the following [3,4].

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1. A single source will provide better service (service is one way that private industry employs to measure quality, i.e., on time delivery, customer satisfaction, etc.).

2. A single source will provide the lowest cost.

3. A single source will work with the purchasing company and that company will in turn help to develop the single source to prevent quality deficiencies.

4. Loyalty development between the company and the single source.

Another industry problem is that there exists no consensus of the definition of and measurement of quality. Each individual company appears to have defined and measured quality attributes differently. The measurement of quality together with the "definition" of quality used in this study are discussed below in paragraph VIC., Measurement of Quality.

B. Measurement of Competition. The second step of the analysis was to define competition. Depending on the parameters used, it was found that competition could take on various forms. The approach employed by this analysis together with the development of the data for defining competition are discussed below.

1. Approach

The first step of the analysis was to identify the NSNs which had a change in competition status. For the purpose of this study, both competition breakouts and NSNs that reverted to sole source were analyzed. A breakout was defined for this study to be an NSN which was formerly procured from a sole source manufacturer that was subsequently solicited in a competitive environment. Whereas a reversion was defined to be a NSN which was formerly solicited in a competitive environment that was subsequently procured from a sole source manufacturer. (Note: The Acquisition Method Codes indicated either competition or sole source.) Within both breakout NSNs and reversion NSNs, the population was further classified into two groups. In the first case, under competitive environments, contracts were awarded to multiple manufacturers. In the second case, under competitive environments, all contracts after break out were awarded to the original sole source manufacturer although the NSN was coded as being eligible for competition. The Acquisition Method Code/Acquisition Method Suffix Code (AMC/AMSC) was used to identify potential NSNs with changes in competition status - changes in the AMC codes from sole source to competition and from competition to sole source. These codes were used since they were judged to be reliable, reflected the decision of the Primary Inventory Control Activity from a planned procurement review, assigned by the DSCs and used by competition advocates to identify NSNs when computing competition savings.

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The potential NSNs were then matched with Commercial and Government Entity (CAGE) codes. CAGE codes are assigned to manufacturers, dealers, vendors, etc. who supply items to the government. The CAGE codes were obtained from the approved source listing contained in the CTDF file, the part number segment of the CTDF file, and actual purchases from the ACF file. These CAGE codes were then matched with two different files in order to determine if the source was a manufacturer. Those NSN/CAGE pairings which were identified as a nonmanufacturer, maintenance activity, or distributor were eliminated. When it was found that an NSN had multiple CAGEs with the same manufacturer's part number, it was assumed that all CAGEs were distributors and consequently that NSN was subsequently eliminated from the analysis. For this study, any questionable NSN/CAGE pairing was eliminated from the analysis.

The remaining NSNs were then divided into the following categories based on the changes in the AMC/AMSC codes.

    a. Breakouts.

        (1) Breakouts from a sole source manufacturer to multiple manufacturers.

        (2) Breakouts from a sole source manufacturer to a single source manufacturer. This represents the case where the original manufacturer was identified as the sole source and was the only source for the item after the item was broken out to competition. This assumed that the NSN was competitively solicited but that the original sole source manufacturer had a competitive advantage and thus always won the award.

    b. Reversions.

        (1) Reversions from multiple manufacturers to a sole source manufacturer.

        (2) Reversions from a single source manufacturer under competition to sole source manufacturer. For example, if an NSN was competitively solicited, but only one bidder consistently offered, then reversion to negotiation under sole source procedures was considered and the AMC/AMSC codes were updated to reflect sole source.

    2. **Development of Data**

The competition status change dates were obtained from the CTDF file. The Specification/Drawing/Publication (S/D/P) segment indicated the before and after AMC/AMSC codes along with the date of change. When the S/D/P segment did not contain the necessary coding to identify changes in the AMC/AMSC codes then the header portion of the CTDF file was used to identify AMC/AMSC codes changes and to obtain the date of change. This entailed using yearly files and comparing the AMC/AMSC changes from year to year. It should be noted that only DCSC required this latter method.

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The AMC codes were used to identify changes in competition status. AMC codes "1" and "2" indicated competition whereas codes "3," "4" and "5" indicated sole source. The AMSC codes were used to determine if adequate technical data packages were available for competition. The AMSC codes which indicated insufficient technical data package were "A," "D," "H," "J," "P," "R" and "U." When the AMC code indicated competition and the AMSC code indicated insufficient technical data package, then the NSN was not considered. Appendix A lists the various AMC/AMSC codes and definitions.

Two different files were used to determine the type of CAGE. The CAGE file from the Defense Logistics Services Center indicated the Type of Enterprise i.e., manufacturer, nonmanufacturer and North Atlantic Treaty Organization manufacturer and the Facility Profile from the Defense Contract Administration Services (DCAS) Quality Assurance Management Information System indicated the Operation Type, i.e., design and manufacturer, manufacturer, maintenance, and distributor. Table 2 shows the codes for both the CAGE file and the Facility Profile file. Again, it should be noted that the NSN/CAGE pairing was dropped from the analysis if either the Type of Enterprise code or the Operation Type code indicated that the CAGE was not a manufacturer, i.e. if the Type of Enterprise code was "F" or if the Operation Type code was "C" or "D."

Table 2

CAGE IDENTIFICATION

Type of Enterprise
(Source: Defense Logistics Services Center)

CODE	DEFINITION
A	Manufacturer
E	NATO Manufacturer
F	Non manufacturer

Operation Type
(Source: Defense Contract Administrative Services)

CODE	DEFINITION
A	Design and Manufacturer
B	Manufacturer
C	Maintenance
D	Distributor

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C. **Measurement of Quality.** The third step of the analysis was to determine how quality would be defined and measured. The actual measure of quality was the lack of quality, i.e., comparison of contractor-caused complaints before and after the date of break out. The measurement of lack of quality was used because the available data only tracks complaints and problems. The approach used to define quality and to develop the quality data are discussed below.

1. **Approach**

There were several indicators of quality employed in this study. First, Product Quality Deficiency Reports (PQDRs) and Reports of Discrepancy (RODs) caused by the contractor were used to indicate the quality of NSNs. PQDRs and RODs measure reported problems with an NSN and did not indicate whether an NSN produced by a particular CAGE was superior in quality. The PQDR/ROD occurrences prior to the competition status change date were compared with the PQDR/ROD occurrences subsequent to the competition status change date in order to determine if the quality improved for a given NSN. It was assumed that if the number of occurrences declined then the quality improved whereas if the number of occurrences increased then the quality decreased. It was additionally assumed that PQDRs, RODs, and other complaints had equal importance and weight.

Second, the QEP data records actions that have been taken against a particular NSN and CAGE pair. These actions or lack of actions were also analyzed. The QEP indicated what actions have been taken in the past for an NSN and CAGE pair which may or may not be necessary in the future. As the Quality Evaluation Program Training Guide states, "Further, use of the information cumulated in the QEP enables the contracting element to make effective use of quality, packaging and shipment histories to minimize awards made to contractors with questionable records. Since the Defense Supply Centers have the responsibility to supply high quality goods and support customer orders, contractors with unsatisfactory quality histories either are not to be awarded contracts or awarded contracts only after careful consideration of their quality histories and future production capacity." Many of the QEP data elements relate to extraordinary measures taken by DSC/DCAS personnel to insure quality requirements were met. As such, they were not indicators of negative quality like the CDCS, but rather measures of resource requirements needed to achieve acceptable levels of quality. If the number of actions increased after competition status changed, then it was assumed that quality decreased whereas if the number of actions decreased, then it was assumed that quality improved. All types of quality actions were considered as being equal in weight.

2. **Development of Data.** The two sources used to define quality are discussed below.

a. **CDCS Data.** The data from the CDCS file consisted of the type of complaint, the date the complaint was initiated, the cause of the complaint, the Procurement Instrument Identification Number (PIIN) and the CAGE code. The PIIN and CAGE code was used to match the complaint to the

contract from the ACF file. The date of the contract was compared to the date of the AMC/AMSC change to determine if the complaint was associated with a contract before or after the competition status changed. The complaints consisted of QDRs, RODs, and others. Table 3 lists the various codes and the document type used from the CDCS file. Contractor-caused complaints were coded as "CN," "CS" and "CP."

b. QEP Data. The data from the QEP file consisted of the following:

(1) First Article (FA) Data - included data on qualification substitute, status (approved, conditionally approved, disapproved or waived) and results (FA data may occur up to three times);

(2) Preaward Survey Data - preaward survey information included major factors (technical capability, production capability, Quality Assurance (QA) capability, financial capability and accounting system) and other factors (government property, transportation, packaging, security, safety, environment/energy and other);

(3) Post Award Data - consisted of significant results/findings for the latest post award conference, Quality Systems Review (QSR) and Quality Systems Management Visit (QSMV);

(4) Nonconformance Data - nonconformance data consisted of types of nonconformances including waivers (major and minor) and deviations (major and minor), QA recommendation, Procuring Contracting Officer action, coordinating activity, date of nonconformance and number;

Table 3

CDCS DOCUMENT TYPE CODES

Category	CDCS Document Type	Definition
PQDR	0	Category I PQDR, SF 368, Phone Call, or Message
	1	Category II PQDR, SF 368, Phone Call, or Message
ROD	6	SF 364, ROD, Direct Vendor Delivery to Customer
	7	SF 364, ROD, Depot Delivery to Customer
	8	SF 364, ROD, Depot Customer Return
	9	SF 364, ROD, Depot Contract Receipt
OTHER	2	Phone call, Message, or Other
	3	SF 361, Discrepancy in Shipment Report
	4	DLA Quality Audit
	5	DD Form 1225, Storage and Quality Control Report

(5) Special QA Data - recorded any special QA actions taken with the date and comments (may occur up to four times);

(6) Quality Assurance Letter of Instruction (QALI) - consisted of the reason for the QALI (restrict use of Certificate of Conformance by Contract Administration Office, Center Imposed Inspections, Technical Activity Imposed Inspections, Past Contractor Quality Problems, Past Item Quality Problems, Nonconformance Acceptance Withheld, Additional Quality Data and Individual Repair Parts Ordering Date); and

(7) Quality Data - consisted of quality requirement (No specific quality requirement, contractor responsibility provision, standard inspection requirement, inspection system i.e., MIL-I-45208A or equivaient, quality program i.e., MIL-Q-9858A or equivalent, contractor paid U. S. Department of Agriculture inspection, contractor paid U. S. Department of Commerce inspection, DPSC alternative requirement clause and other than above), acquisition quality assurance (destination or origin), acceptance site (destination or origin) and certificate of conformance.

The above elements were matched to the contracts from the ACF file by matching the NSN and CAGE pair with the PIIN. The award date of the contract from the ACF was compared to the date of change of the AMC/AMSC codes to determine if the QEP actions were associated with a contract before or after the competition status change date. The steps taken to develop the data base and to analyze the data are illustrated by Figure 1.

VII. ANALYSIS. The analysis consisted of two approaches. First, the CDCS data were plotted. The number of competition status changes per quarter and the number contractor-caused complaints per quarter were plotted. These graphs compared the centers and illustrated the limitations of the data. Second, the data were analyzed using Statistical Package for the Social Sciences (SPSS) Crosstabs option to compare the before competition status change CDCS performance and QEP pattern with the respective after competition status change performance or pattern. Statistical hypothesis tests were run to determine if there was a significant difference between the before and after data. The results of the data plots and hypothesis tests are discussed below.

A. Data Analysis. The number of competition status changes per quarter and the number of contractor-caused complaints for competition status changes per quarter were plotted. Figures 2 and 3 show these plots. These graphs show the limitation of the data. One limitation that was apparent was the end of the data time period as evident by the downward slopes. These slopes were caused by the length of time to close out CDCS complaints (3 to 6 months and longer), the length of time between awarding a contract and receiving a complaint (6 months and longer) and the length of time between a competition status change date and a contract award under the new competition status (months to years).

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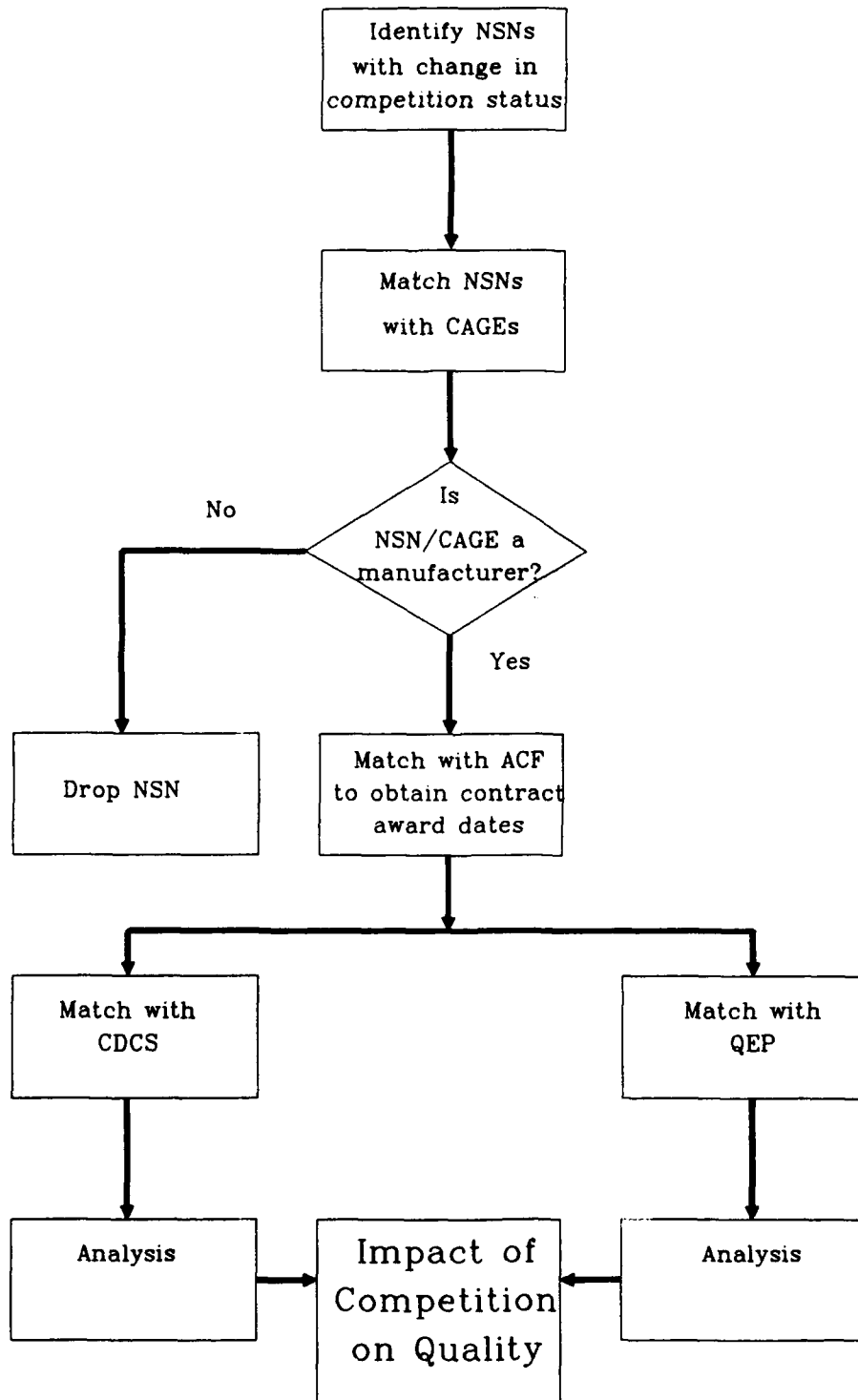
Figure 1
DATA FLOW

Figure 2

COMPETITION STATUS CHANGES
(CHANGES IN AMC/AMSC CODES)
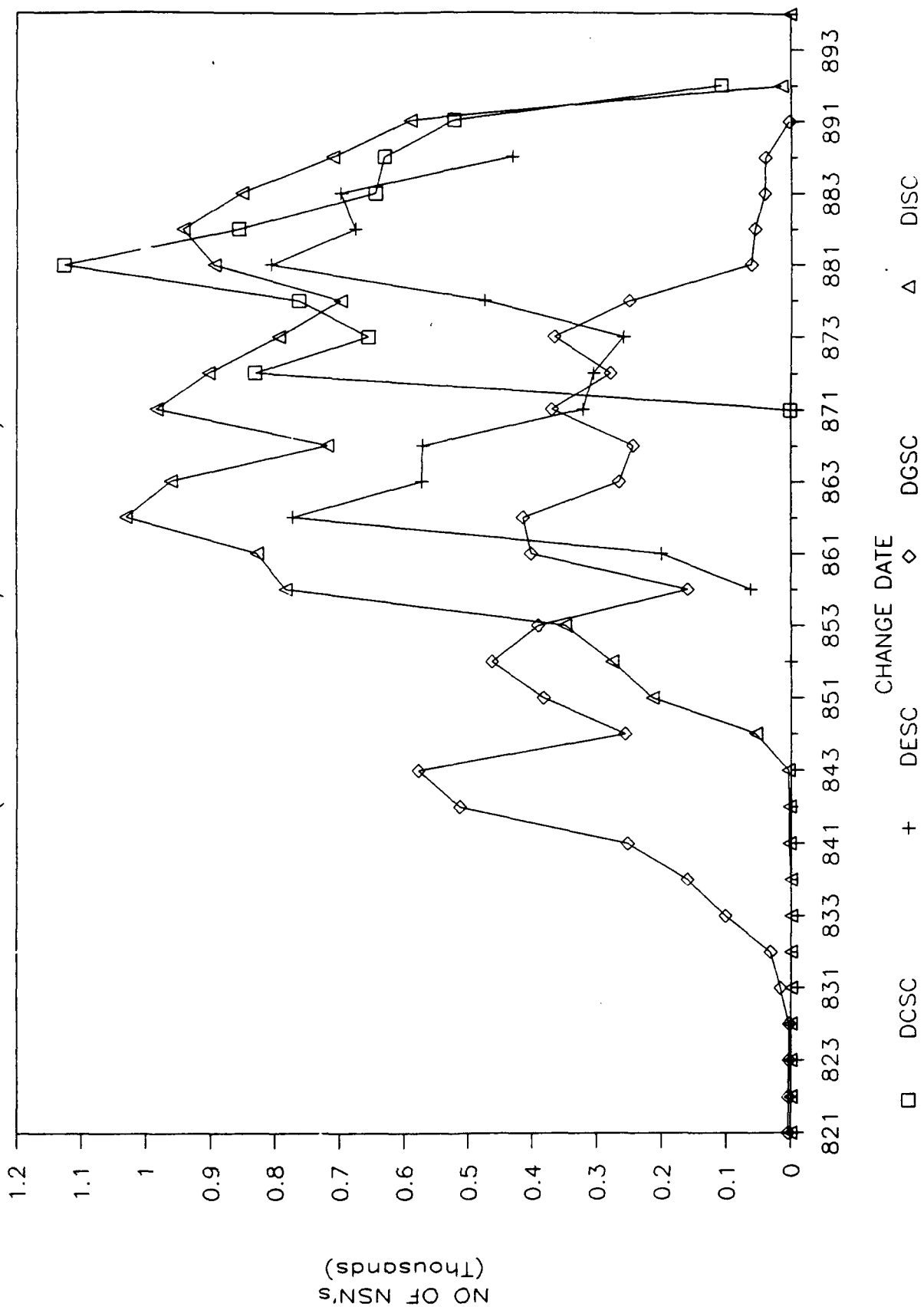
Figure 3

CDCS — CONTRACTOR CAUSED COMPLAINTS

(MATCHED W/COMPETITION STATUS CHANGES)
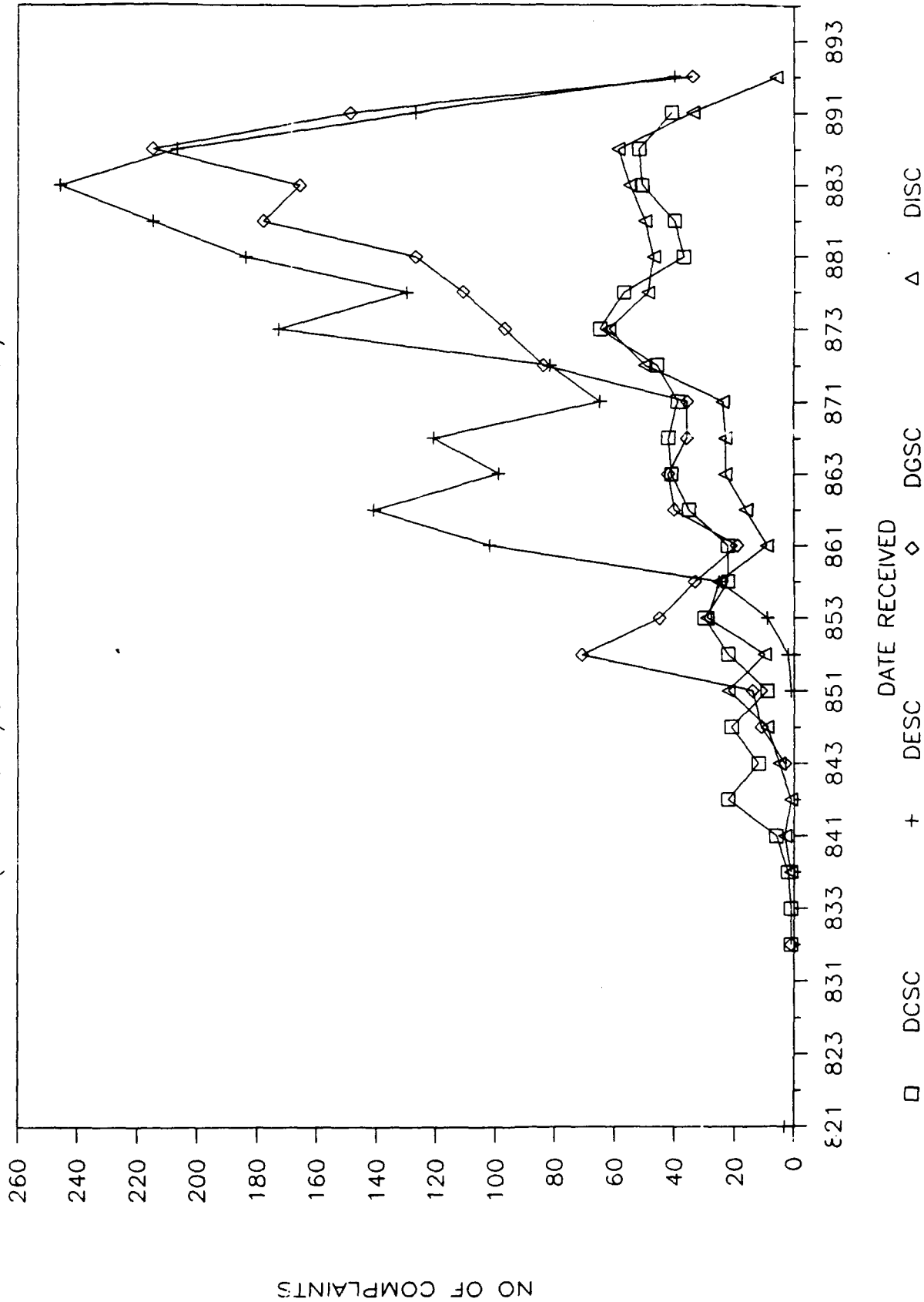
1. **Competition Status Changes.** Figure 2 compares the number of identified competition status changes with each center. This graph was based on the study methodology previously described in paragraph VIB., Measurement of Competition. Actual breakouts were ongoing at all centers throughout the 1980s. Note that DGSC and DISC had the longest recorded history of competition status changes starting in the first quarter of 1982 (quarter 821), DESC competition status changes started in the second quarter of 1985 (quarter 852) and DCSC started in the first quarter of 1987 (quarter 871). DCSC's missing data prior to 1987 was caused by the method used to identify the AMC/AMSC code changes as explained in paragraph VIB2., Development of Data. The data build up period (FY 82-85) was caused by the fact that the DLA Operations Research and Economic Analysis Management Support Office did not begin to collect contracting data until FY 85. These competition status changes represent NSNs whose AMC codes changed from either sole source (codes of "3," "4," or "5") to competition (codes of "1" or "2") or competition to sole source and have actual manufacturer CAGEs associated with them. The drop off in the number of competition status changes from the fourth quarter of 1988 on were due to the end of the data collection period (results of the time lag to verify code changes and to award a contract under the new code). It should be noted that the time period for stable data was from 1986 through 1988 except for DCSC which turned out to be 1987 through 1988.

2. **CDCS - Contractor-Caused**

The contractor-caused CDCS complaints matched with the competition status changes associated with manufacturers are depicted by Figure 3. There were apparent increasing slopes which were associated with the data build up. Two reasons for the build up were:

    a. The build up matches the AMC/AMSC changes; and

    b. The CDCS file was a new data base. New data bases will require time to capture all transactions.

The sharp decreases were due to the end of the data collection. The sudden drop was a result of delays in establishing cause codes which were required to close out a record on the CDCS file. There were complaints on file during the drop off, but these complaints were not counted because the cause codes were not yet determined. Notice that the number of contractor-caused complaints for DESC and DGSC appeared to be high, peaking a range from 170 to 250 per quarter, whereas the number of contractor cause complaints for DCSC and DISC were lower peaking with a range from 40 to 60 per quarter.

3. **Relationships.** The number of competition status changes and the number of contractor-caused complaints were plotted for each center to illustrate the relationships between the two. These relationships are discussed by center below.

a.   **DCSC.**   The impact of comparing yearly CTDF header segments for competition status change identifications was clearly evident by Figure 4.   The data for competition status change ranged from 1987 (quarter 871) through the second quarter of 1989 (quarter 892).   This limited range restricted our ability to measure the effect at DCSC to the same degree as the other DSCs. The number of contractor-caused complaints remained relatively level even when the number of competition status changes varied.

b.   **DESC.**   Figure 5 indicated that the number of contractor-caused complaints and the number of competition status changes tended to move (increase and decrease) in the same direction together.

c.   **DGSC.**   Figure 6 indicated that the number of contractor-caused complaints increased while the number of competition status changes tended to decrease from the first quarter of 1987 (871) onward.

d.   **DISC.**   Figure 7 indicated that the number of contractor-caused complaints tended to remain level while the number of competition status changes varied in a range from 700 to 1000.

B.   **CDCS Data**

The limitation of the data, previously discussed, and the low number of contractor-caused complaints may influence the results.   Table 4 lists the number of observations, the number of contractor-caused complaints, and the percentage of contractor-caused complaints for each center.   The percentage of contractor-caused complaints ranged from a low of 1.88 percent to a high of 7.60 percent with an average 4.02 percent.   Thus, complaints were relatively rare occurrences with or without competition.

The following hypotheses were tested:

1.   The null hypothesis was   that the CDCS record types were equally likely to occur under both types of competition (sole source versus competition).

2.   The alternative   hypothesis was that the CDCS record types were **not** equally likely to occur under both types of competition.

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Figure 4

DCSC

Competition Status Changes & Complaints

Figure 5

DESC

Competition Status Changes & Complaints
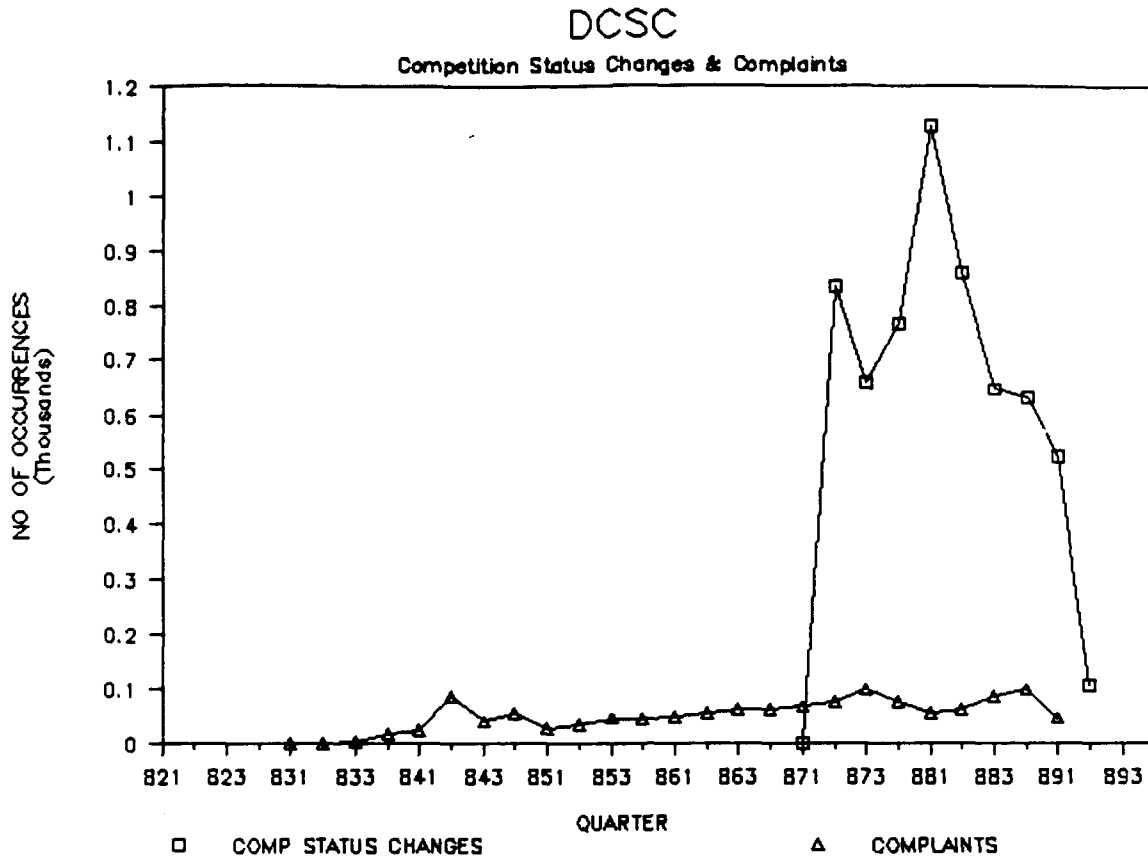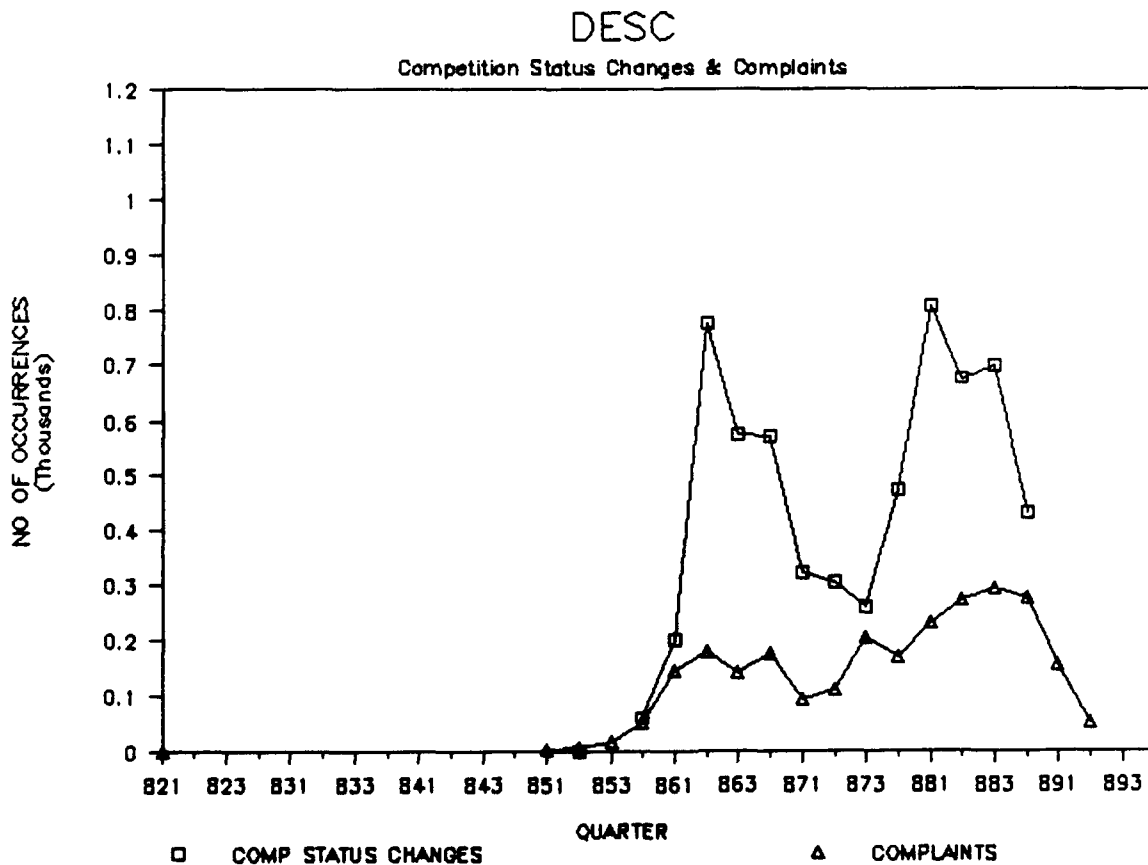
Figure 6

DGSC

Competition Status Changes & Complaints

NO OF OCCURRENCES (Thousands)

QUARTER

□ COMP STATUS CHANGES   △ COMPLAINTS
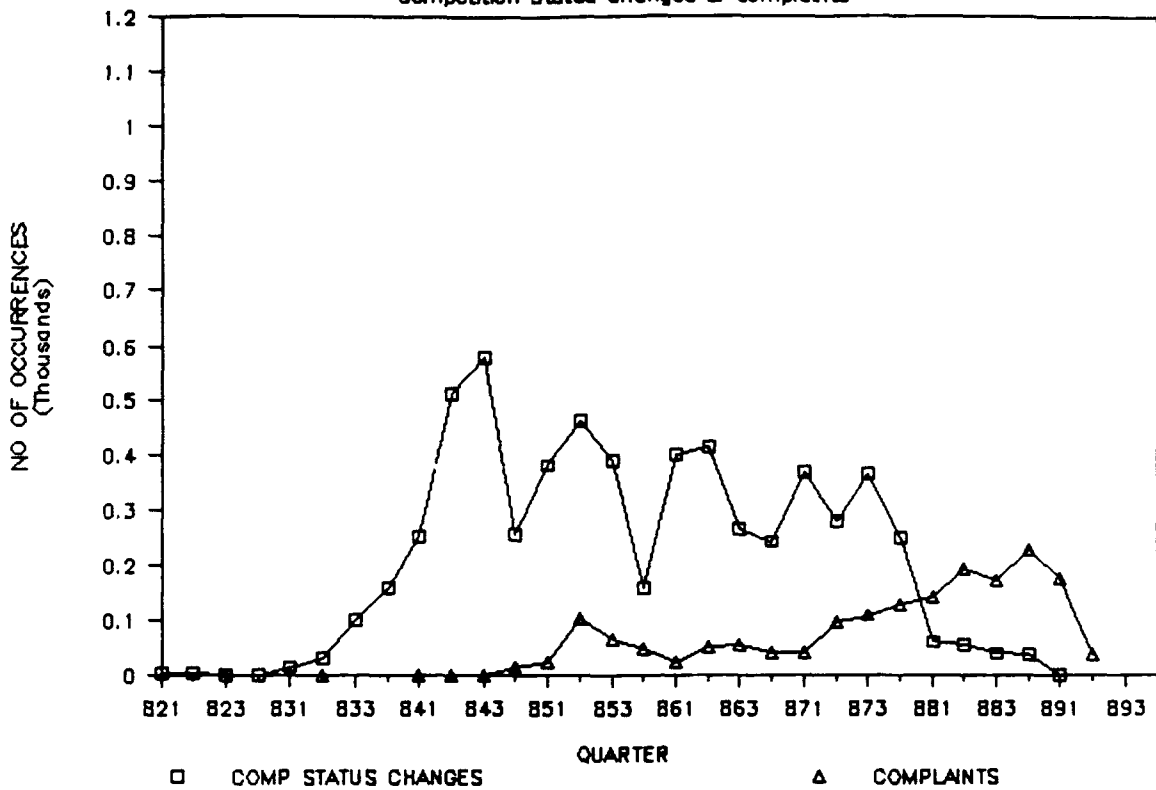
Figure 7

DISC

Competition Status Changes & Complaints

NO OF OCCURRENCES (Thousands)

QUARTER

□ COMP STATUS CHANGES   △ COMPLAINTS

16
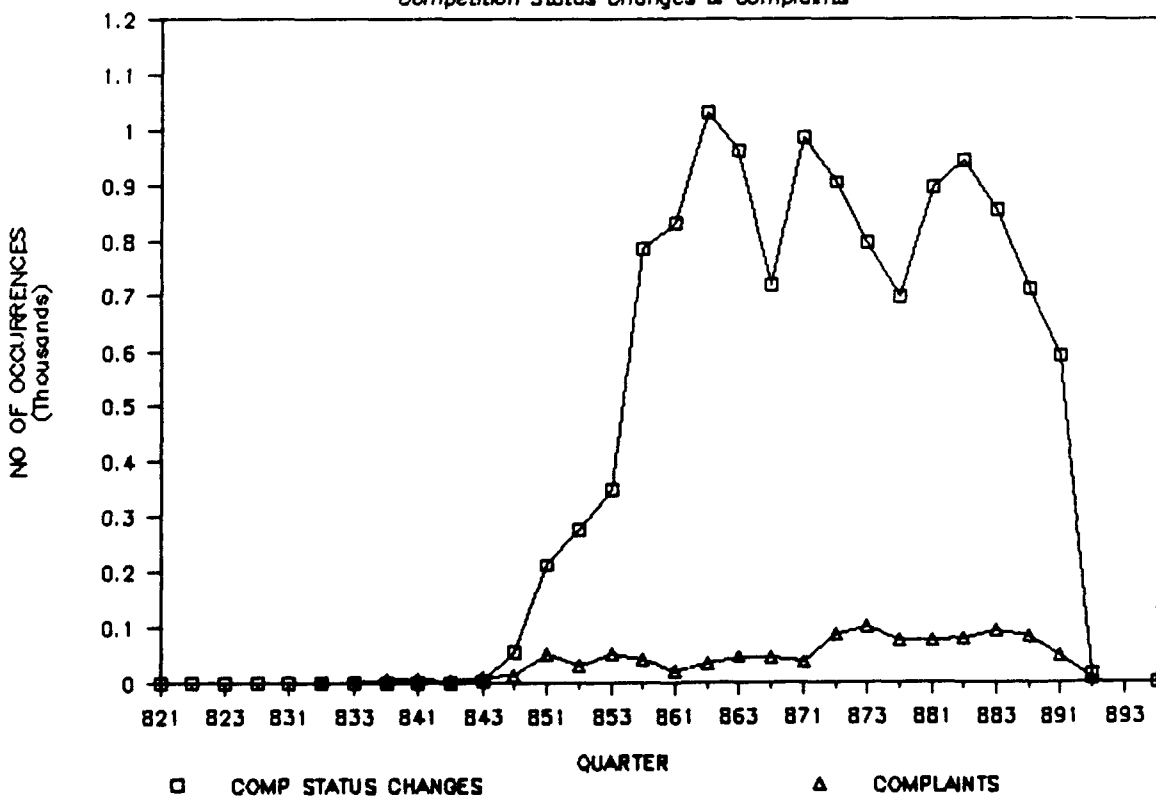
Table 4

PERCENTAGE OF CONTRACTOR-CAUSED COMPLAINTS

Center	Number of contract lines	Number of contractor-caused complaints	Percentage of contractor-caused complaints
DCSC	9,118	292	3.20%
DESC	11,483	873	7.60%
DGSC	22,987	1,057	4.60%
DISC	21,865	411	1.88%
TOTALS	65,453	2,633	4.02%

The null hypothesis indicated that the variable, CDCS record type and type of competition, were independent (i.e., unrelated) whereas the alternative hypothesis indicated that the variables were dependent (i.e., related). When the null hypothesis was accepted, there was consequently no relation between CDCS record type and the type of competition. This meant that the various CDCS record types were just as likely to occur before competition status change as afterwards. Whereas when the alternative hypothesis was accepted, then there was a statistical relationship indicated between the CDCS record types and type of competition. This could be interpreted to indicate that the various CDCS record types were more likely to occur under one type of competition (competition or sole source) than under the other.

The level of significance of the test was selected to be 0.01. This meant that 1 percent of the time the null hypothesis would be rejected when it should have been accepted. Table 5 provides a summary of the results and Appendix B provides the SFSS output of the crosstabulations and hypotheses tests for the various centers and cases.

The results from Table 5 were mixed. Table 5 indicates that the relationship between competition and quality was positive for DCSC and DISC in that more frequent complaints were received under sole source conditions. However, the relationship was negative for DESC and DGSC when NSNs were broken out from sole source to competition. Both, DCSC and DISC data analysis (Figure 4 and Figure 7) illustrated that the number of contractor-caused complaints were relatively constant while the number of competition status changes varied. This may account for the positive impact of competition on quality. DESC and DGSC data analysis (Figure 5 and Figure 6) illustrated that the number of contractor-caused complaints tended to increase while the number of competition status changes increased for DESC and decreased for DGSC. This would serve to indicate that there had been a potential negative impact of competition on quality for DESC and DGSC.

Table 5

CDCS RESULTS

| | Multiple sources | | Single source | |
	Sole source to Competition	Reversion	Sole source to Competition	Reversion
DCSC	R+ (2758)	R+ (1457)	A+ (3424)	R+ (1479)
DESC	R- (5099)	X (0)	R- (6373)	X (11)
DGSC	R- (21727)	A- (693)	R- (528)	X (39)
DISC	A+ (7339)	A+ (408)	R+ (13376)	A+ (742)

Legend:

A - Accept the Null hypothesis - the type of competition and record type are unrelated

R - Reject the Null hypothesis and accept the alternative - the type of competition and record type are related

- - Decrease in quality (more complaints - percentage wise)

+ - Improvement in quality (fewer complaints - percentage wise)

X - Insufficient data

Numbers in ( )'s are the number of contract lines (The CDCS numbers and the QEP numbers may not agree because a contract line may have multiple complaints and/or multiple QEP requirements.)

The results for reversions (when competition reverts back to sole source) were counter-intuitive. If competition had an effect on quality then the reversion cases should have opposite signs from the breakout cases. This was not observed. Reversions, tended to have the same effect as breakouts (same sign). The results of the reversion cases were: three cases did not have sufficient data (both of DESC's and DGSC single source case); two cases had a significant positive impact (both of DCSC's cases); two cases had an insignificant positive impact (both of DISC's cases); and only one case had an insignificant negative impact (DGSC multiple source case). Reversion accounted for only 4,829 observations or only 7.4 percent of all the observations. The relatively low number of occurrences and the fact that the results were significant at DCSC (which had the least reliable data for determining the date of competition status change) suggests that more data is needed to draw conclusions concerning reversion.

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C. **QEP Data**

The low number of QEP actions for competition status changes are illustrated in Table 6. The number of observations, the number of QEP actions, and the percentage of QEP actions are listed for each center. The percentage of QEP actions ranged from a low of .77 percent to a high of 6.06 percent, giving an overall QEP action average of 3.77 percent.

Table 6

PERCENTAGE OF QEP ACTIONS

Center	Number of contract lines	Number of QEP actions	Percentage of QEP actions
DCSC	8,715	67	.77%
DESC	10,883	660	6.06%
DGSC	22,565	837	3.71%
DISC	21,493	839	3.90%
TOTALS	63,656	2,403	3.77%

The hypotheses tested were the following:

1. The null hypothesis was that the QEP record types were equally likely to occur under both types of competition (competition or sole source).

2. The alternative hypothesis was that the QEP record types were not equally likely to occur under both types of competition.

The null hypothesis indicated that the variables, QEP record type and type of competition, were independent (i.e., unrelated) whereas the alternative hypothesis indicated that the variables were dependent (i.e., related). When the null hypothesis was accepted, then there was no apparent relation between QEP record type and the type of competition. This meant that the various QEP record types were just as likely to occur after break out to competition as compared to the prior sole source conditions. When the alternative hypothesis was accepted, it was inferred that there was a relationship between the QEP record types and type of competition. This could be interpreted that the various QEP record types were more likely to occur under one type of competition than the other.

The null hypothesis was rejected at the significant level of 0.01. This meant that 1 percent of the time the null hypothesis would be rejected when it should have been accepted. Table 7 provides the summary results and Appendix C provides the SPSS output of the crosstabulations and hypotheses tests for the various centers and cases. These results are discussed below.

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The results for the scenarios of breaking out an NSN were consistent from center to center. After an NSN was broken out, more quality actions occurred. In six out of eight cases, the results were significant at a level of 0.01. For multiple sources cases, DESC, DGSC and DISC results were significant indicating an increase in QEP actions after break out. The results for single source cases were also significant for DCSC, DESC and DISC indicating an increase in QEP actions. Even when the differences were insignificant, the percentage of QEP actions increased after breakout.

Table 7

QEP RESULTS

	Multiple sources		Single source	
	Sole source to competition	Reversion	Sole source to competition	Reversion
DCSC	A- (2624)	A+ (1310)	R- (3382)	A+ (1399)
DESC	R- (4745)	X (0)	R- (6127)	X (11)
DGSC	R- (21356)	A- (676)	A- (494)	X (39)
DISC	R- (7203)	R- (374)	R- (13185)	R- (731)

Legend: A — Accept the Null hypothesis - the type of competition and record type are unrelated

R — Reject the Null hypothesis and accept the alternative - the type of competition and record type are related

- — Decrease in quality (more QEP actions - percentage wise)

+ — Improvement in quality (fewer QEP actions - percentage wise)

X — Insufficient data

Numbers in ( )'s are the number of contract lines (The CDCS numbers and the QEP numbers may not agree because a contract line may have multiple complaints and/or multiple QEP requirements.)

The reversion scenarios produced mixed results. The total number of observations for reversion was only 4,540 or 7.1 percent of the total number of observations. The results depicted that two cases had a positive impact, but the differences were not statistically significant (both of DCSC's cases), three cases had insufficient data (both of DESC's and DGSC single source case) and the remaining three cases had a negative impact (DGSC multiple sources case and both of DISC's cases). DGSC multiple sources case was statistically insignificant whereas DISC's cases were statistically significant.

The results of the QEP data were counter-intuitive for some of the reversion cases. Again, it was expected that if competition had an impact on quality then the signs would be opposite of the sole source to competition cases. This only occurred for DCSC with insignificant results. DESC had insufficient data. DGSC results were insignificant. Finally, DISC results for multiple sources and single source were significant. In general, the lack of observations on reversion to sole source limits any conclusion on evaluation of quality changes.

APPENDIX A

AMC and AMSC Codes Listing

AMC CODES

Code	Definition
1	Competitive
2	Competitive first time
3	Direct Purchase Manufacturer
4	Direct Purchase from Actual Manufacturer
5	Noncompetitive

AMSC CODES

Code	Definition
A	Government's rights questionable.
B	Restricted to specified source(s).
C	Engineering source approval by design control activity. Contracting from approved source(s).
D	Data needed to purchase from additional sources is not physically available.
E	Contracting status can be improved.
F	Item is in phased provisioning.
G	Technically suitable and legally clear for advertising and data package is complete.
H	Government does not have in its possession sufficient, accurate, or legible data to purchase item from other sources.
J	Contracting restricted to system prime contractor.
K	Class 1A castings (MIL-C-6021) or similar type forgings.
L	Uneconomical to undertake improve contract status.
M	Application of master or coordinated tooling.

AMSC CODES

Code	Definition
N	Requires special test and/or inspection facilities to maintain ultraprecision quality.
P	Rights of data legally unavailable and cannot be acquired by purchase.
Q	Exceptional unique manufacturing processes or materiels.
R	Data or rights to data are not owned by the Government and are uneconomical to acquire.
S	Contracting restricted to limited source(s) because of security classification.
T	Contracting controlled by Qualified Products List procedures.
U	Uneconomical to compete.
V	High reliability part under a formal reliability program.
W	Purchase by method indicated if military or adopted industry specifications are substituted for contractor's data which are subject to Government's limited rights of use.
Y	Design of item is unstable.
Z	Contracting from the current source is necessary to ensure standardization and interchangeability of parts.

APPENDIX B

CDCS Data - Crosstabulations

These crosstabulation tables were grouped by center for each scenario. The record type from the CDCS file was listed across the top of the table, these were labeled as follows:

1. NONE - No complaints

2. OTHER - Other complaints

3. QDRS - PQDRs, both types I and II

4. RODS - RODS, all types.

The type of competition was labeled along the left hand side. The labels used were:

1. COMP - Competition

2. SOLE - Sole source.

The number of observations with the percentage for the row were provided in the boxes. The title of the table refers to the direction of the competition change (i.e., breakout or reversion). For sole source ɔ competition one should compare the values starting with "SOLE" and going to "COMP." Using the NONE (No complaints) column, if the percentage value increased then the number of complaints have decreased whereas if the percentage value decreased then the number of complaints increased. The table title provides the scenario as listed below:

1. Multiple Sources - multiple sources have been awarded contracts for the NSN.

2. Single Source - a single source has been awarded contracts for the NSN, both before and after break out.

The Chi-square statistic was used to evaluate the discrepancy between observed frequencies and expected frequencies. The significance indicated whether to accept or reject the null hypothesis (see text paragraph VIIB., CDCS Data).

Table B-1

CDCS - SOLE SOURCE TO COMPETITION - MULTIPLE SOURCES
DCSC

```
       COUNT  I
       ROW PCT I                                              ROW
              I                                               TOTAL
              I NONE   I OTHER  I QDRS    I RODS   I
       --------+--------+--------+--------+--------+
        COMP  I   957  I    .2  I         I     9  I   968
              I  98.9  I    .2  I         I    .9  I  35.1
              +--------+--------+--------+--------+
        SOLE  I  1708  I    28  I   16  I    38  I  1790
              I  95.4  I   1.6  I   .9  I   2.1  I  64.9
              +--------+--------+--------+--------+
       COLUMN    2665      30      16       47     2758
       TOTAL     96.6     1.1      .6      1.7    100.0
```

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
25.31799	3	0.0000	5.616	NONE

Table B-2

CDCS - COMPETITION TO SOLE SOURCE - MULTIPLE SOURCES
DCSC

```
       COUNT  I
       ROW PCT I                                              ROW
              I                                               TOTAL
              I NONE   I OTHER  I QDRS    I RODS   I
       --------+--------+--------+--------+--------+
        COMP  I  1022  I    29  I    30  I    20  I  1101
              I  92.8  I   2.6  I   2.7  I   1.8  I  75.6
              +--------+--------+--------+--------+
        SOLE  I   350  I     1  I     3  I     2  I   356
              I  98.3  I    .3  I    .8  I    .6  I  24.4
              +--------+--------+--------+--------+
       COLUMN    1372      30      33       22     1457
       TOTAL     94.2     2.1     2.3      1.5    100.0
```

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
15.10740	3	0.0017	5.375	NONE

B-3

Table B-3

CDCS - SOLE SOURCE TO COMPETITION - SINGLE SOURCE
DCSC

COUNT ROW PCT		NONE	OTHER	QDRS	RODS	ROW TOTAL
COMP	I	1217 99.1	I	I .1	1 I .8	10 35.9	1228
SOLE	I	2150 97.9	12 .5	6 .3	28 1.3	2196 64.1
COLUMN TOTAL		3367 98.3	12 .4	7 .2	38 1.1	3424 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
9.74886	3	0.0208	2.511	3 OF 8 (37.5%)

Table B-4

CDCS - COMPETITION TO SOLE SOURCE - SINGLE SOURCE
DCSC

COUNT ROW PCT		NONE	OTHER	QDRS	RODS	ROW TOTAL
COMP	I	809 94.1	28 3.3	7 .8	16 1.9	860 58.1
SOLE	I	613 99.0	I	I	G 1.0	619 41.9
COLUMN TOTAL		1422 96.1	28 1.9	7 .5	22 1.5	1479 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
28.03487	3	0.0000	2.930	2 OF 8 (25.0%)

Table B-5

CDCS - SOLE SOURCE TO COMPETITION - MULTIPLE SOURCES
DESC

COUNT ROW PCT		NONE	OTHER	QDRS	ROOS	ROW TOTAL
COMP	I	1496 89.7	24 1.4	11 .7	137 8.2	1668 32.7
SOLE	I	3171 92.4	25 .7	42 1.2	193 5.6	3431 67.3
COLUMN TOTAL		4667 91.5	49 1.0	53 1.0	330 6.5	5099 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
21.86769	3	0.0001	16.029	NONE

Table B-6

CDCS - COMPETITION TO SOLE SOURCE - MULTIPLE SOURCES
DESC

THE   2-WAY TABLE FOR THE FOLLOWING VARIABLES WAS EMPTY.
COM   RECT

Table B-7

CDCS - SOLE SOURCE TO COMPETITION - SINGLE SOURCE DESC

COUNT ROW PCT	I NONE	I OTHER	I QDRS	I RODS	I	ROW TOTAL
COMP	I 2199 I 92.8	I 5 I .2	I 1 I .0	I 164 I 6.9	I I	2369 37.2
SOLE	I 3734 I 93.3	I 44 I 1.1	I 23 I .6	I 203 I 5.1	I I	4004 62.8
COLUMN TOTAL	5933 93.1	49 .8	24 .4	367 5.8		6373 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
35.35692	3	0.0000	8.921	NONE

Table B-8

CDCS - COMPETITION TO SOLE SOURCE - SINGLE SO   E DESC.

COUNT ROW PCT	I NONE	I RODS	I	ROW TOTAL
COMP	I 6 I 85.7	I 1 I 14.3	I I	7 63.6
SOLE	I 4 I 100.0	I I	I I	4 36.4
COLUMN TOTAL	10 90.9	1 9.1		11 100.0

STATISTIC	ONE TAIL	TWO TAIL
FISHER'S EXACT TEST	0.63636	1.000

Table B-9

COCS - SOLE SOURCE TO COMPETITION - MULTIPLE SOURCES
DGSC

COUNT ROW PCT	NONE	OTHER	QDRS	RODS	ROW TOTAL
COMP	16466 94.9	306 1.8	101 .6	476 2.7	17349 79.8
SOLE	4290 98.0	17 .4	21 .5	50 1.1	4373 20.2
COLUMN TOTAL	20756 95.5	323 1.5	122 .6	526 2.4	21727 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
85.65453	3	0.0000	24.583	NONE

Table B-10

COCS - COMPETITION TO SOLE SOURCE - MULTIPLE SOURCES
DGSC

COUNT ROW PCT	NONE	OTHER	QDRS	RODS	ROW TOTAL
COMP	82 97.6	1 1.2		1 1.2	84 12.1
SOLE	562 92.3	19 3.1	6 1.0	22 3.6	609 87.9
COLUMN TOTAL	644 92.9	20 2.9	6 .9	23 3.3	693 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
3.31069	3	0.3462	0.72?	3 01 1 (37 5")

Table B-11

COCS - SOLE SOURCE TO COMPETITION- SINGLE SOURCE
DGSC

COUNT ROW PCT	NONE	OTHER	QDRS	RODS	ROW TOTAL
COMP	322 90.2	4 1.4	18 5.0	13 3.6	357 67.6
SOLE	170 99.4			1 .6	171 32.4
COLUMN TOTAL	492 93.2	4 .8	19 3.6	13 2.5	528 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
15.58063	3	0.0014	1.295	3 OF 8 (37.5%)

Table B-12

COCS - COMPETITION TO SOLE SOURCE- SINGLE SOURCE
DGSC

COUNT ROW PCT	NONE	RODS	ROW TOTAL
COMP	17 100.0		17 43.6
SOLE	21 95.5	1 4.5	22 56.4
COLUMN TOTAL	38 97.4	1 2.6	39 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
0.00000	1	1.0000	0.436	2 OF (50)
0.79306	1	0.3732	(BEFORE YATES CORRECTION)	

Table B-13

CDCS - SOLE SOURCE TO COMPETITION - MULTIPLE SOURCES
DISC

COUNT ROW PCT	I NONE	I OTHER	I QDRS	I RODS	I	ROW TOTAL
COMP	I 3375 I I 98.0 I	14 I .4 I	14 I .4 I	40 I 1.2 I	3443 46.9
SOLE	I 3818 I I 98.0 I	16 I .4 I	10 I .3 I	52 I 1.3 I	3896 53.1
COLUMN TOTAL	7193 98.0	30 .4	24 .3	92 1.3	7339 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
1.69356	3	0.6384	11.259	NONE

Table B-14

CDCS - COMPETITION TO SOLE SOURCE - MULTIPLE SOURCES
DISC

COUNT ROW PCT	I NONE	I OTHER	I QDRS	I RODS	I	ROW TOTAL
COMP	I 271 I I 91.2 I	7 I 2.4 I	13 I 4.4 I	6 I 2.0 I	297 72.8
SOLE	I 107 I I 96.4 I	I I	I I	4 I 3.6 I	111 27.2
COLUMN TOTAL	378 92.6	7 1.7	13 3.2	10 2.5	408 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
8.53265	3	0.0362	1.90	3 OF 4 (37.5%)

Table B-15

CDCS - SOLE SOURCE TO COMPETITION - SINGLE SOURCE DISC

COUNT ROW PCT	I NONE	I OTHER	I QDRS	I RODS I	ROW TOTAL
COMP	I 7084 I I 98.7 I	11 I .2 I	9 I .1 I	76 I 1.1 I	7180 53.7
SOLE	I 6077 I I 98.1 I	22 I .4 I	22 I .4 I	75 I 1.2 I	6196 46.3
COLUMN TOTAL	13161 98.4	33 .2	31 .2	151 1.1	13376 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
13.86189	3	0.0031	14.360	NONE

Table B-16

CDCS - COMPETITION TO SOLE SOURCE - SINGLE SOURCE DISC

COUNT ROW PCT	I NONE	I OTHER	I QDRS	I RODS I	ROW TOTAL
COMP	I 361 I I 96.5 I	4 I 1.1 I	3 I .8 I	6 I 1.6 I	374 50.4
SOLE	I 361 I I 98.1 I	I I	I I	7 I 1.9 I	368 49.6
COLUMN TOTAL	722 97.3	4 .5	3 .4	13 1.8	742 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
7.02886	3	0.0710	1.48R	4 OF 3 (50 C)

APPENDIX C

QEP Data - Crosstabulations

These crosstabulation tables were grouped by center for each scenario. The record type from the QEP file was listed across the top of the table, these were labeled as follows:

1. ALI - Quality Assurance Letter of Instruction

2. FA - First Article Data

3. LTY - Quality Data

4. N/A - No Actions - No QEP actions taken

5. NON - Non-conformance Data

6. PA - Post Award Data

7. PAS - Preaward Survey Data

8. SQA - Special QA Data

The type of competition was labeled along the left hand side. The labels used were:

1. COMP - Competition

2. SOLE - Sole source.

The number of observations with the percentage for the row were provided in the boxes. The title of the table refers to the direction of the competition change (i.e., breakout or reversion). For sole source to competition one should compare the values starting with "SOLE" and going to "COMP." Using the N/A (No Actions) column, if the percentage value increased then the number of actions have decreased whereas if the percentage value decreased then the number of actions increased. The table title provides the scenario as listed below:

1. Multiple Sources - multiple sources have been awarded contracts for the NSN.

2. Single Source - a single source has been awarded contracts for the NSN, both before and after break out.

The Chi-square statistic was used to evaluate the discrepancy between observed frequencies and expected frequencies. The significance indicated whether to accept or reject the null hypothesis (see text paragraph VIIC., QEP Data).

Table C-1

QEP - SOLE SOURCE TO COMPETITION - MULTIPLE SOURCES
DCSC

COUNT ROW PCT	FA	LTY	N/A	NON	SQA	ROW TOTAL
COMP	1 .1	2 .2	946 98.9	5 .5	3 .3	957 36.5
SOLE	1 .1	3 .2	1657 99.4	1 .1	5 .3	1667 63.5
COLUMN TOTAL	2 .1	5 .2	2603 99.2	6 .2	8 0	2624 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
5.89397	4	0.2072	0.729	7 OF 10 (70 0%)

Table C-2

QEP - COMPETITION TO SOLE SOURCE - MULTIPLE SOURCES
DCSC

COUNT ROW PCT	FA	N/A	NON	PA	SQA	ROW TOTAL
COMP	4 .4	945 97.7	6 .6	5 .5	7 .7	967 73.8
SOLE	1 .3	341 99.4	 	1 .3	 	343 26.2
COLUMN TOTAL	5 .4	1286 98.2	6 .5	6 .5	7 .5	1310 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
5.06506	4	0.2807	1.309	7 OF 10 (70.0)

Table C-3

QEP - SOLE SOURCE TO COMPETITION - SINGLE SOURCE
DCSC

```
       COUNT  I
       ROW PCT I                                              ROW
              I                                               TOTAL
              I  FA    I  LTY   I  N/A   I  NON   I  SOA   I
     ---------+--------+--------+--------+--------+--------+
       COMP   I   5    I    1   I  1204  I    4   I    3   I  1217
              I  .4    I   .1   I  98.9  I   .3   I   .2   I  36.0
              +--------+--------+--------+--------+--------+
       SOLE   I   1    I    3   I  2159  I        I    2   I  2165
              I  .0    I   .1   I  99.7  I        I   .1   I  64.0
              +--------+--------+--------+--------+--------+
       COLUMN     6         4      3363       4        5      3382
       TOTAL      .2        .1     99.4      .1       .1     100.0
```

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
14.46562	4	0.0059	1.439	8 OF 10 (80.0%)

Table C-4

QEP - COMPETITION TO SOLE SOURCE - SINGLE SOURCE
DCSC

```
       COUNT  I
       ROW PCT I                              ROW
              I                               TOTAL
              I  N/A   I  NON   I  SOA   I
     ---------+--------+--------+--------+
       COMP   I  780   I    2   I    1   I  783
              I  99.6  I   .3   I   .1   I  56.0
              +--------+--------+--------+
       SOLE   I  616   I        I        I  616
              I 100.0  I        I        I  44.0
              +--------+--------+--------+
       COLUMN    1396       2        1      1399
       TOTAL     99.8      .1       .1     100.0
```

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
2.36523	2	0.3065	0.440	4 OF 6 (66.7%)

C-4

Table C-5

QEP - SOLE SOURCE TO COMPETITION - MULTIPLE SOURCES
DESC

COUNT ROW PCT	FA	LTY	N/A	NON	PAS	SOA	ROW TOTAL
COMP	2 .1	125 8.2	1370 89.8	15 1.0	10 .7	4 .3	1526 32.2
SOLE	1 .0	85 2.6	3105 96.5	19 .6	7 .1	6 .2	3219 67.8
COLUMN TOTAL	3 .1	210 4.4	4475 94.3	34 .7	13 .3	10 .2	4745 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
93.05813	5	0.0000	0.965	4 OF 12 (33.3%)

Table C-6

QEP - COMPETITION TO SOLE SOURCE - MULTIPLE SOURCES
DESC

THE 2-WAY TABLE FOR THE FOLLOWING VARIABLES WAS EMPTY.
COM   RECT

Table C-7

QEP - SOLE SOURCE TO COMPETITION - SINGLE SOURCE DESC

COUNT ROW PCT	ALI I	.FA I	LTY I	N/A I	NON I	PAS I	SQA I	ROW TOTAL
COMP	I	2 I	215 I	2032 I	29 I	1 I	3 I	2282
	I	.1 I	9.4 I	89.0 I	1.3 I	.0 I	.1 I	37.2
SOLE	1 I	I	105 I	3706 I	26 I	3 I	1 I	3815
	.0 I	I	2.7 I	96.4 I	.7 I	.1 I	.1 I	62.8
COLUMN	1	2	320	5738	55	4	7	6127
TOTAL	.0	.0	5.2	93.7	.9	.1	.1	100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
140.94054	6	0.0000	0.372	8 OF 14 (57.1%)

Table C-8

QEP - COMPETITION TO SOLE SOURCE - SINGLE SOURCE DESC

COUNT ROW PCT	LTY I	N/A I	ROW TOTAL
COMP	I	7 I	7
	I	100.0 I	63.6
SOLE	1 I	3 I	4
	25.0 I	75.0 I	36.4
COLUMN	1	10	11
TOTAL	9.1	90.9	100.0

STATISTIC	ONE TAIL	TWO TAIL
FISHER'S EXACT TEST	0.36364	0.36364

Table C-9

QEP - SOLE SOURCE TO COMPETITION - MULTIPLE SOURCES
DGSC

COUNT ROW PCT	ALI	FA	LTY	N/A	SOA	ROW TOTAL
COMP	5 .0	11 .1	700 4.1	16271 95.7	19 .1	17003 79.6
SOLE			43 1.0	4305 99.0		1717 20.4
COLUMN TOTAL	5 .0	11 .1	743 3.5	20579 96.4	19 .1	21356 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
109.97484	4	0.0000	1.018	4 OF 10 (40.0%)

Table C-10

QEP - COMPETITION TO SOLE SOURCE - MULTIPLE SOURCES
DGSC

COUNT ROW PCT	ALI	LTY	N/A	NON	SOA	ROW TOTAL
COMP		1 1.2	83 98.8			84 12.4
SOLE	1 .2	37 6.3	552 93.2	1 .2	1 .2	592 87.6
COLUMN TOTAL	1 .1	38 5.6	635 93.9	1 .1	1 .1	676 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
4.01825	4	0.4035	0.124	7 OF 10 (70.0%)

Table C-11

QEP - SOLE SOURCE TO COMPETITION - SINGLE SOURCE
OGSC

```
COUNT   I
ROW PCT I                              ROW
        I                              TOTAL
        I    ALI   I   LTY   I   N/A   I
--------+-------+-------+-------+
  COMP  I    4   I   10   I  309   I   323
        I  1.2   I  3.1   I  95.7   I  65.4
        +-------+-------+-------+
  SOLE  I       I    3   I  168   I   171
        I       I  1.8   I  98.2   I  34.6
        +-------+-------+-------+
 COLUMN      4       13      477      494
 TOTAL       .8      2.5     96.6    100.0
```

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
2.95943	2	0.2277	1.385	3 OF 6 (50.0%)

Table C-12

QEP - COMPETITION TO SOLE SOURCE - SINGLE SOURCE
OGSC

```
COUNT   I
ROW PCT I                      ROW
        I                      TOTAL
        I   LTY   I   N/A   I
--------+-------+-------+
  COMP  I       I   17   I   17
        I       I 100.0  I  43.6
        +-------+-------+
  SOLE  I    2  I   20   I   22
        I  9.1  I  90.9  I  56.4
        +-------+-------+
 COLUMN     2       37       39
 TOTAL     5.1     94.9    100.0
```

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F. < 5
0.29628	1	0.5862	0.872	2 OF 4 (50.0%)
1.62899	1	0.2018	(BEFORE YATES CORRECTION)	

C-8

Table C-13
QEP - SOLE SOURCE TO COMPETITION - MULTIPLE SOURCES
DISC

COUNT ROW PCT	ALI	FA	LTY	N/A	NON	SOA	ROW TOTAL
COMP	11 .3	50 1.5	206 6.1	3092 91.5	12 .4	7 .2	3378 46.9
SOLE	2 .1	15 .4	10 .3	3794 99.2	3 .1		3825 53.1
COLUMN TOTAL	13 .2	65 .9	216 3.0	6886 95.6	16 .2	7 .1	7203 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
258.75157	5	0.0000	3.283	2 OF 12 (16.7%)

Table C-14
QEP - COMPETITION TO SOLE SOURCE - MULTIPLE SOURCES
DISC

COUNT ROW PCT	ALI	FA	LTY	N/A	NON	SOA	ROW TOTAL
COMP	1 .4	5 1.9	1 .4	257 96.6	1 .4	1 .4	266 71.1
SOLE		2 1.9	9 8.3	96 88.9	1 .9		108 28.9
COLUMN TOTAL	1 .3	7 1.9	10 2.7	353 94.4	2 .5	1 .3	374 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
19.92342	5	0.0013	0.289	9 (75)

C-9

Table C-15

QEP - SOLE SOURCE TO COMPETITION - SINGLE SOURCE DISC

COUNT ROW PCT	ALI	FA	LTY	N/A	NON	SOA	ROW TOTAL
COMP	13 .2	44 .6	339 4.8	6687 94.1	16 .2	7 .1	7106 53.9
SOLE	5 .1	14 .2	19 .3	6030 99.2	9 .1	2 .0	6079 46.1
COLUMN TOTAL	18 .1	58 .4	358 2.7	12717 96.5	25 .2	9 .1	13185 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
265.40215	5	0.0000	4.149	2 OF 12 (16.7%)

Table C-16

QEP - COMPETITION TO SOLE SOURCE - SINGLE SOURCE DISC

COUNT ROW PCT	FA	LTY	N/A	SOA	ROW TOTAL
COMP	2 .5	5 1.4	358 97.8	1 .3	366 50.1
SOLE		25 6.8	340 93.2		365 49.9
COLUMN TOTAL	2 .3	30 4.1	698 95.5	1 .1	731 100.0

CHI-SQUARE	D.F.	SIGNIFICANCE	MIN E.F.	CELLS WITH E.F.< 5
16.79618	3	0.0008	0.499	4 0. (5) ())

APPENDIX D

List of Abbreviations

Abbreviation	Meaning
ACF	Active Contract File
AMC	Acquisition Method Code
AMSC	Acquisition Method Suffix Code
CAGE	Commercial and Government Entity
CDCS	Customer Depot Complaint System
CTDF	Contracting Technical Date File
DCAS	Defense Contract Administration Services
DCSC	Defense Construction Supply Center
DESC	Defense Electronics Supply Center
DGSC	Defense General Supply Center
DISC	Defense Industrial Supply Center
DLA	Defense Logistics Agency
DLA-LO	DLA Operations Research and Economic Analysis Office
DPSC	Defense Personnel Support Center
DSC	Defense Supply Center
FA	First Article
FY	Fiscal Year
NSN	National Stock Number
PIIN	Procurement Instrument Identification Number
PQDR	Product Quality Deficiency Report
QA	Quality Assurance
QALI	Quality Assurance Letter of Instruction
QEP	Quality Evaluation Program
QSMV	Quality Systems Management Visit
QSR	Quality Systems Review
ROD	Report of Discrepancy
S/D/P	Specification/Drawing/Publication
SPSS	Statistical Package for the Social Sciences

APPENDIX E

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The Defense Logistics Agency (DLA) Competition Advocate Office requested that DLA'S Operations Research and Economic Analysis Office (DLA-LO) determine the impact of competition and how it affects the quality of items bought by the Defense Supply Centers (DSCS). This study details the analysis of how competition impacts quality of DLA-managed items. Specifically addressed were how the quality patterns of items broken out from sole source to multiple sources and those items which reverted from multiple sources to sole source have changed. For the vast majority of items broken out to competition there were no recorded valid contractor-caused complaints from the Customer Depot Complaint System (CDCS) file and no recorded Quality Evaluation Program (QEP) actions. When complaints from the CDCS were present, the results were mixed. When QEP activity occurred, it was more frequent after breakout than before. Therefore, it appears that there were no measurable differences in the quality of items after breakout to competition.

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